The Ruth H. Hooker Research Library

and Technical Information Center

Campus-wide network access to CD-ROM databases

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- **Keywords:**

  CD-ROM, LAN, Campus Network, TCP/IP, NOVELL$_{©}$, Operating Systems, Macintosh, Naval Research Laboratory

- **Abstract:**

  The Ruth H. Hooker Research Library and Technical Information Center of the Naval Research Laboratory has installed an in-Library CD-ROM network, which is searchable throughout the 130-acre, 152-building campus over an Ethernet and FDDI backbone. Known as InfoNet, the system comprises: a NOVELL$_{©}$ LAN connecting computers on two floors of the Library building; a CD-ROM server; and special purpose software to allow simultaneous multi-user access to CD-ROM databases. This general purpose microcomputer hardware and off-the-shelf software is configured to enable users on the campus backbone using the TCP/IP suite of protocols to execute CD-ROM searches from their laboratories and offices. Macintosh users, whose native Apple File Protocol (AFP) communication is supported by the campus network, can connect directly over the campus network to the InfoNet CD-ROM access server to search DOS-based CD-ROM databases. All other platforms, including PCs, UNIX and VAX workstations as well as dumb terminals, use Telnet to communicate with an InfoNet Telnet host, which runs multi-user Interactive UNIX with TCP/IP software. The CD-ROM databases available through InfoNet include: Applied Science & Technology Index (Wilson); Computer Select^{TM} (Ziff Davis); and Inspec (UMI).

1.0 INTRODUCTION

The Ruth H. Hooker Research Library and Technical Information Center of the Naval Research Laboratory (NRL) has installed an in-Library CD-ROM network and implemented access through the campus Ethernet and FDDI network, NICENET, to enable users throughout the 130-acre, 152-building campus to perform CD-ROM searches. Off-the-shelf hardware and software were utilized to enable users with a wide variety of terminals, microcomputers and workstations to conduct (CD-ROM searches from their offices and laboratories. Users need no additional hardware or software for CD-ROM access beyond that already required to access NICENET. The system, known as InfoNet, is restricted to NRL employees and on-site contractors to facilitate licensing. InfoNet has been designed so that it can at a later date be connected to other automated library and information systems, providing the Laboratory with a complete Campus Wide Information System.

2.0 NRL ENVIRONMENT AND INFORMATION REQUIREMENTS

NRL was established in 1923 by the Government at the urging of Thomas Edison for a National laboratory to serve the country's defense needs. Today NRL serves as the Navy's corporate laboratory, conducting research in such areas as acoustics, biochemistry, chemistry, electronics, information technology. materials science, particle and plasma physics, optics and space science.

The Library meets the information needs of NRL's research community, which consists of about 3500 Federal staff and about 1200 contractors. Since 1983, end users have been able to search the Library's online catalog both on site and remotely. However, library reference staff continued to handle all other online searching. This situation began to change in 1988 when the Library introduced CD-ROM databases in both its reference area and in its Microcomputer Software Support Center for end user searching. Users responded favorably to the CD-ROM products, enjoying the freedom to explore that comes with performing their own searches (Ref.1). Impetus for providing network access to CD-ROM databases was provided by a User Needs Analysis, conducted in 1990 to develop specifications for a replacement Library system; it showed that scientists throughout the laboratory wanted access to information resources from their own computers or workstations[1].

To accomplish the goal of making CD-ROMs searchable over NICENET, the Library and its contractor, Kestrel Associates Incorporated, had to deal with two basic issues[2]. The first of these is the DOS operating system adopted by most commercial CD-ROM publishers. The second is the wide variety of equipment in use at the Laboratory. These include hundreds of dumb terminals that provide access to the Laboratory's mainframe computers, SMTP E-mail system and administrative files: hundreds, perhaps thousands of PC compatible and Macintosh computers in heavy use in both research and administrative areas; and a large number of SUN, VAX and other Workstations used by the researchers.

3.0 SYSTEM REQUIREMENTS AND RESTRICTIONS

NRL's Research Computation Division (RCD) maintains, troubleshoots, and polices the campus communications backbone. In an effort to position itself to comply with GOSIP standards, RCD currently restricts NICENET communications protocols to TCP/IP, DECNet Phase V and Apple File Protocol Phase II (AFP). Since InfoNet is a Library subnetwork, it must provide typical LAN capabilities utilizing standard application software packages in addition to providing Library staff the capability to Telnet out to other Internet resources, and to dial out asynchronously to services such as Dialog.

Basic system requirements and restrictions are listed below:

- Can use only TCP/IP, DECNet or AFP on Campus backbone
- Cannot require any software that would require expenditures by campus users
- Must provide access for all NRL campus computer platforms
- Must provide CPU facilities for multiple simultaneous MS-DOS CD-ROM searches
- Must allow Library staff to Telnet out of the subnetwork.
- Must allow the Library staff to dial out asynchronously to other resources.
- Must be cost effective
- Must allow future GOSIP compliance.

4.0 INFONET SYSTEM CONFIGURATION

As configured, the InfoNet complies with campus-wide networking requirements and allows all NICENET users CD-ROM search capability regardless of computing platform or location. Up to thirty NICENET users can be supported simultaneously and an additional seventy users can access the system from inside the Library. Moreover, the InfoNet is readily expandable and makes use of both standard hardware and off-the-shelf software.

The InfoNet system utilizes three 80486-based access servers: two running NetWare© Access Server[3] (NAS) and one multi-user Interactive UNIX with TCP/IP software[4]; and one 80486- based file server running NOVELL© NetWare© v3.11[5] NetWare© for Macintosh v3.01[6], and SCSI Express for NetWare 386© [7] (Figure 1). Two Ethernet network interface cards are installed in the file server to take advantage of NOVELL© NetWare© 3.11's multi-protocol router software. The router software serves a dual function: it is required on the InfoNet to stop non-NICENET supported protocols from entering the campus-wide network; and it prevents unwanted NICENET packets from entering InfoNet and reducing overall subnetwork performance.

Once a user is logged into the InfoNet, CD-ROM data is provided by one of two options. The first option, which is available to all users, involves communicating directly with the NOVELL© file server. CD-ROMs cannot normally

be mounted on a file server without the use of special software. The Library selected MDI's 7 SCSI Express for NetWare 386© to perform this task. This software will mount any device, such as a CD-ROM, WORM or tape drive, as a volume on the NOVELL© file server. SCSI adapter cards can be added to the file server with each card supporting up-to seven internal or external CD-ROM drives (Ref. 2).

The second option is available for internal subnetwork users only. Because SCSI Express does not work for CD-ROM products which make specific calls to Microsoft CD-ROM Extensions (MSCDEX), several of the desired InfoNet products, such as Books in Print™ Plus (Bowker), will not work with SCSI Express. To alleviate this problem until another cost effective solution is found, InfoNet utilizes a CBIS CD-ROM server to provide internal network access for products that require the use of Microsoft CD-ROM Extensions, and SCSI Express for all other products. The CBIS CD-ROM Server[8] is a dedicated 80486 computer with 7 CD-ROM drives attached via a SCSI adapter.

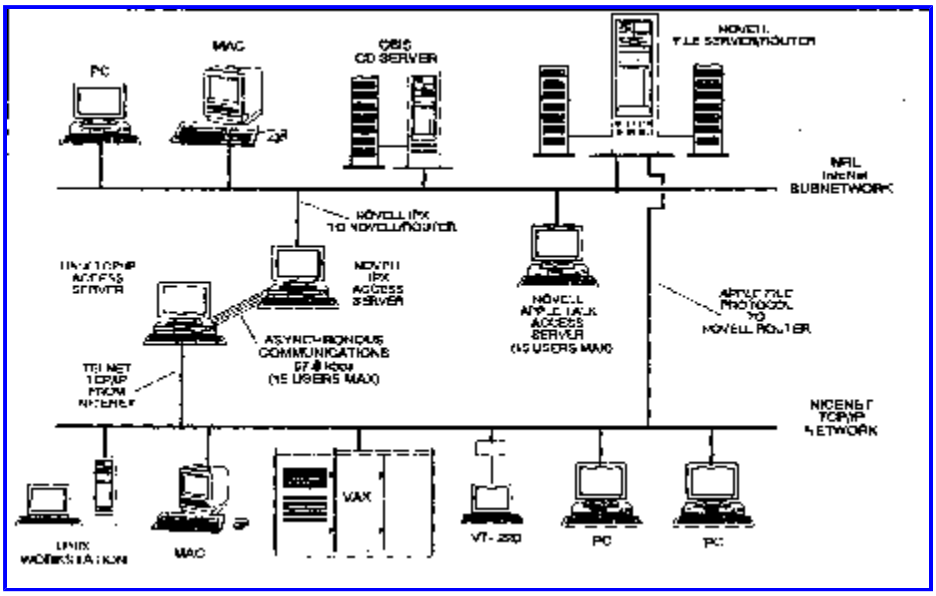

Figure 1. InfoNet System Configuration

5.0 DISCUSSION OF THE CAMPUS-WIDE AREA NETWORK SOLUTION

During a four month research and development period, a multitude of both hardware and software solutions were evaluated for multi-platform TCP/IP access to Library-based CD-ROMs. It was found that NOVELL© NetWare© hosts can support a variety of communications protocols including TCP/IP. Unfortunately, NOVELL© 's support for TCP/IP is limited to IP tunneling, TCP/IP routing, and NFS mounting. The final InfoNet solution involves the integration of a combination of hardware and software products.

A physical connection alone could not provide NICENET users a method to search MS-DOS based CD-ROM products running on InfoNet. InfoNet therefore provides NICENET users with network access to a CPU on which to run MS-DOS CD-ROM searches. This CPU is controlled by special software (NetWare© Access Server™ (NAS) v.1.2) and the combination is called an access server. To provide for all the aforementioned requirements two access systems were utilized: one for Macintosh; and one for all other computer platforms communicating with TCP/IP.

5.1 Access for Macintosh Users (AFP)

Because NRL NICENET policy permits only TCP/IP, DECNet and AFP protocols to exist on the campus communications backbone, the Library set up two separate systems for computer platform access. The first system provides Macintosh users a user friendly method for InfoNet acccess. The system utilizes a 80486 micro-computer configured with 16 MB of RAM and NOVELL© v2.1 Access Server (NAS) Software. The NOVELL© software

provides an AFP interface so that NICENET Macintosh users log into the InfoNet via their point-and-click native AFP "chooser" and run OnLAN/MAC™ software. OnLAN/Mac™ software is provided with NAS for an unlimited number of users and resides on the file server to give Macintosh users PC terminal emulation once activated. OnLAN/Mac™ software connects Macintosh users to the NAS. At this point a DOS session is initiated which permits Macintosh users to perform CD-ROM searching. PC function keys are mapped to the Macintosh and a function key display is provided for mouse utilization should the user lack an extended keyboard (Ref. 3). It should be noted that the system requires NetWare© for Macintosh v3.0 be installed on the file server. This portion of the system allows for connection of up to 15 Macintosh users which timeshare the 80486 processor. Additional Macintosh access in increments of 15 users can be provided by installing an additional NAS unit either a 80386 or 80486 PC. Both the NAS and NetWare© for Macintosh can be purchased for under $2,000.00 each.

5.2 Access for other Computer Platforms (TCP/IP)

For users other than Macintosh the solution installed provides a Teinet host which runs multi user Interactive UNIX with TCP/IP software. This Telnet host runs on an 80486 CPU and allows Telnet users to connect to a second 80486 NAS access server. Users Telnet to the Telnet host and are passed through serial ports directly to the NAS access server which is hard-wired to the serial ports on the Telnet host. The Telnet host communicates asynchronously at 57.8 kbps. Screen refreshing and keyboard commands are the only instructions transferred between the Interactive UNIX system, the NAS access server, and the Telnet users. This part of the Library network allows all users of any type of computer platform (i.e. VAX, PC, UNIX) to Telnet to the library using the TCP/IP protocol[9]. The Telnet access server utilizes three Interactive UNIX products (Interactive UNIX, Interactive Multi-user, Interactive TCP/IP) which allow TCP/IP users Library access. As with the Macintosh server, the Telnet NAS server provides a friendly access to the InfoNet Main Menu. The NAS access server is configured to provide multiple terminal emulation, including VT-100 and VT-220 Support, and maps the keyboard accordingly. Additional multi-user access in increments of 15 users can be added by utilizing additional TCP/IP and NAS access servers.

It should be noted that LAN Workplace for DOS© [10] software allows PC workstations to "IP Tunnel" NOVELL© 's native IPX protocol accessing a TCP/IP network. In other words, IPX packets are encapsulated in TCP/IP by the PC Workstation and sent to the InfoNet. The InfoNet recognizes the packets, performs standard file server functions as it would for any PC client, and responds by sending back IPX packets encapsulated in TCP/IP. NICENET users who are connected to a NOVELL© 3.11 subnetwork or who already have LAN Workplace for DOS© can use this capability to connect directly to the Library's NOVELL© network to search CD-ROM databases.

6.0 LICENSING ISSUES

The purchase of a CD-ROM database is not a transfer of ownership but a license to use the product within the constraints of the licensing agreement. Unlike a sale in which the seller loses all rights except those covered under copyright, license agreements contain specific terms and conditions which control the usage of the product. The CD-ROM vendor controls all rights granted under the license and rights not mentioned in the license must be negotiated. Should the purchaser not be satisfied with the conditions of the license, and the vendor be unwilling to change tile conditions, the purchaser has no recourse other than to refuse the product (Ref. 4).

The most common types of licensing are for individual workstations or for individual users. However. another type of licensing arrangement exists. one that is much more suitable for a campus network environment. It is called concurrent licensing and provides a license for in unrestricted but limited number of simultaneous users who belong to a specific group, Such as a specific site of an agency (Ref. 5).

This form of licensing requires the use of additional software to handle the allocation of CD-ROM access privileges. Metering software functions as a form of overseer, ensuring that simultaneous usage of a product never exceeds the limit imposed by the license. In the case of InfoNet. Saber Meter™[11]. is used to ensure licensing compliance. Concurrent licensing is the only form of license deemed acceptable for the InfoNet (Ref. 6).

Software alteration is a related issue that can hinder license negotiation in campus environments such as NRL. Any alternation of the software is usually prohibited under the licensing agreement even if it is required to make the software network compatible. Restrictions on transferring the data from the CD-ROM onto alternative media are also common. In addition, since most vendors charge either exorbitant rates for dial-in access, or prohibit its use altogether, the InfoNet is unable to offer this service. These restrictions result in artificial limitations on the creation of better CD-ROM networks.

7.0 COSTS

The InfoNet CD-ROM access system uses commercially available off-the-shelf hardware and software components to allow internal and campus wide CD-ROM network access. The costs for the entire system, not including PC or Macintosh computers used as user workstations, was approximately $60,000.

8.0 CONCLUSION

The NRL Library has succeeded in installing a CD-ROM network which complies with all of the requirements and restrictions described in section 3.0 and provides campus wide access for a variety of computer platforms. Most difficult was the requirement to communicate only via TCP/IP, DECNet, or AFP on the campus network backbone. The system allows use of all CD-ROMs which comply with ISO or High Sierra formats within the Library subnetwork and can currently provide access to more than 80% of the products campus wide. The concept of distributed computing was utilized to maintain high performance CD-ROM network access. The Library's system utilizes general purpose 486 microcomputers to allow for low cost additions and modifications to the system as technology in this area continues to advance.

9.0 NOTES

1. The User Needs Analysis was conducted by Nancy K. Roderer of Columbia University.

2. The Library has a multiyear contract with Kestrel Associates Incorporated for automation support. Kestrel provides staffing for the Library's Microcomputer Support Center and is carrying out a project to convert some 100,000 technical reports to optical disc storage. The Library also put into place a small contract with CD Consultants, Inc. as a source of information and advice on networking issues that were unique to CD-ROMs.

3. NetWare, Access Server™ vl.2 #883-000770-002: NOVELL© , Orem, UT.

4. Interactive UNIX #'s OS20036, MU30027, TC00026: Interactive Systems Corporation. Los Angeles, CA.

5. NOVELL© NetWare© v3.11, #883-001343-001: NOVELL© , Orem, UT.

6. NOVELL© NetWare© for Macintosh v3.01, #883-001128-002: NOVELL© , Orem, UT.

7. SCSI Express for NetWare© 386 #SE-NO3.11: Micro Design International, Winter Park, FL.

8. CBIS CD Connection™ #CD-NOV-100: CBIS Inc., Norcross, GA.

9. For NICENET users who may not have Telnet software, NCSA Telnet is freely distributed and supported by NRL's Research and Computation Division. NCSA Telnet is in the pubic domain. NCSA Software Development, Champaign, IL.

10. NOVELL© LAN Workplace for DOS© v4.0 #883-001132-001: NOVELL© , Orem, UT.

11. Saber Meter™, Saber Software Corporation, Dallas, TX

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5. 1991 Network Software Licensing White Paper, Microcomputer Managers Association, Warren, N.J.

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Updated: 27-NOV-95
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